

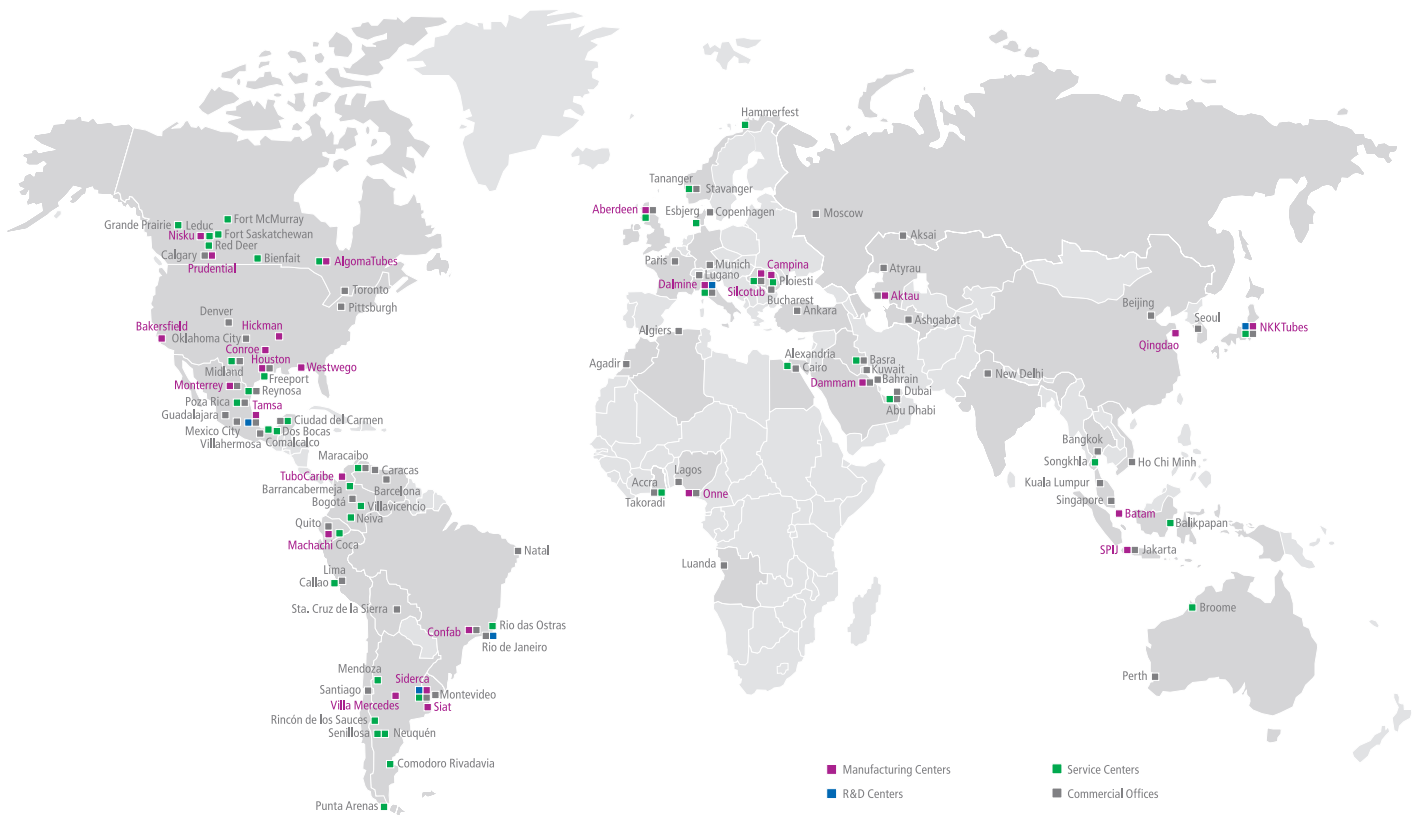
BlueCoil® Technology



Tenaris

Tenaris is a leading supplier of tubes and related services for the world's energy industry and certain other industrial applications. Our mission is to deliver value to our customers through product development, manufacturing excellence, and supply chain management. We seek to minimize

risk for our customers and help them reduce costs, increase flexibility and improve time-to-market. Tenaris employees around the world are committed to continuous improvement by sharing knowledge across a single global organization.



The new standard in coiled tubing

BlueCoil® technology is a unique technology designed to expand the capabilities of coiled tubing and raise the operational quality and performance to the next level. It is also a technology platform for extending coiled tubing capabilities and reliability to meet future extreme operational demands. BlueCoil® technology is based on proprietary steel designs and manufacturing processes to produce coiled tubing that is stronger and more fatigue and environmentally resistant throughout its structure.

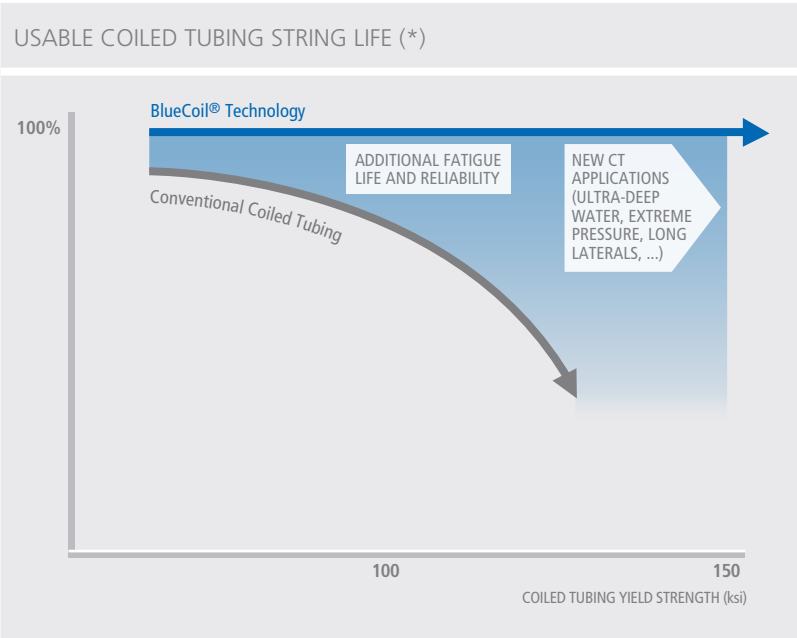
The life of a conventional coiled tubing string is normally limited by the fatigue life of its bias welds. As the required yield strength of coiled tubing increases, the fatigue life of the conventional bias weld decreases relative to the rest of the coiled

tubing string, limiting the useful life of the entire string to the shorter life of the bias weld.

In contrast, the bias weld and base tube fatigue performance of a BlueCoil® string remain comparable for high strength coiled tubing grades, allowing greater utilization of the entire string, bringing additional strength, reliability and longer string life for coiled tubing applications.

BlueCoil® technology is backed by Tenaris's decades of experience and research in pipe manufacturing and metallurgy. BlueCoil® products have undergone comprehensive testing to validate their advanced metallurgical, mechanical, fatigue and environmental performance. Field experience has confirmed quantifiable benefits of BlueCoil® products in real-life operations.

BlueCoil® technology provides extra strength and longer string life.



(*) Based on bias-weld fatigue performance

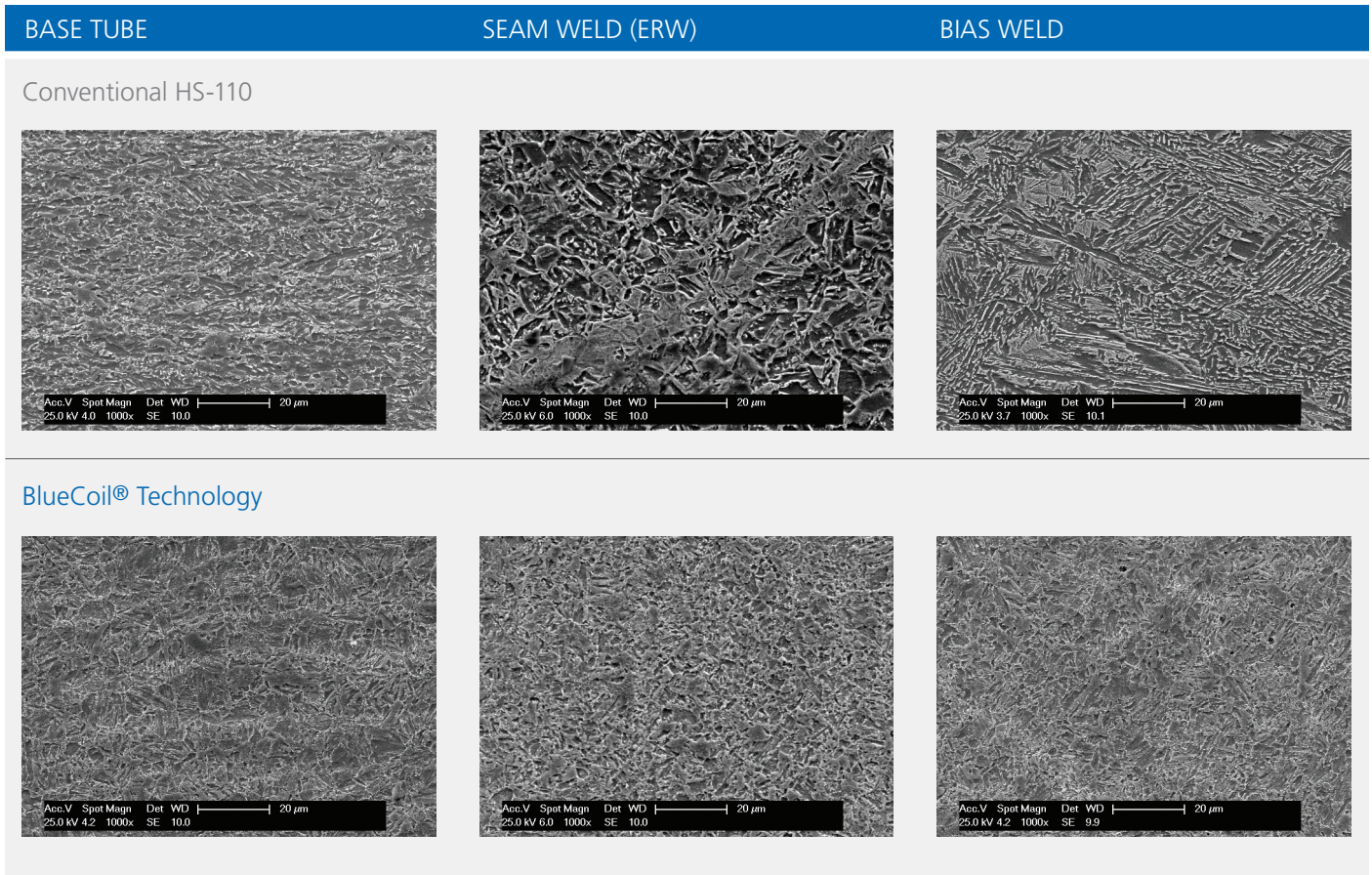
An innovative manufacturing process

To create BlueCoil® technology Tenaris developed steel chemistries and welding and heat-treatment processes that are exclusive for coiled tubing (patents pending.) They were designed to obtain higher strength grades and provide significant improvements in fatigue performance and sulfide stress cracking (SSC) resistance.

Most of the conventional coiled tubing properties are obtained when the flat strips are manufactured at the steel mill. The optimized microstructure and properties of the original flat strip material are later degraded in the bias and seam weld areas.

On the contrary, the final properties of a BlueCoil® string are obtained at the last stage of the manufacturing process. As a result, there is an improved microstructure and more uniform material properties across the entire string, including the bias and seam welds.

Comparisons of typical microstructures.



Advantages that make a difference

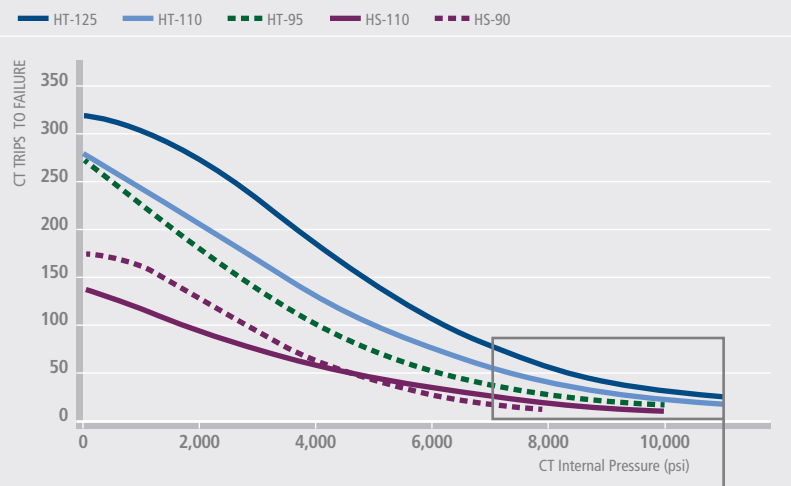
GREATLY IMPROVED GENERAL AND SOUR FATIGUE PERFORMANCE

BlueCoil® technology brings improved fatigue performance over conventional coiled tubing grades. This benefit extends to the bias welds,

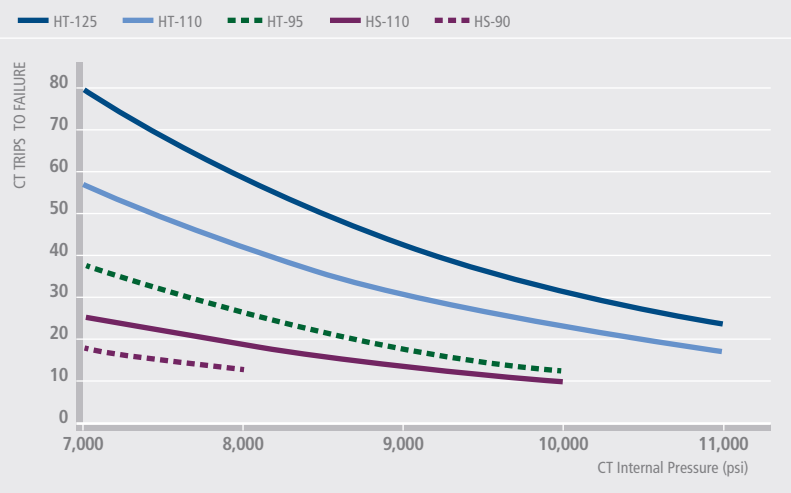
as they have the same improved microstructure as the base tube. In conventional coiled tubing, the shorter fatigue life of the bias weld limits the useful life of the entire string. With BlueCoil® technology, the fatigue life of the bias weld is similar to that of the base tube.

Fatigue performance of BlueCoil® tubing grades vs. conventional HS-110 and HS-90 grades for a typical coiled tubing setup.

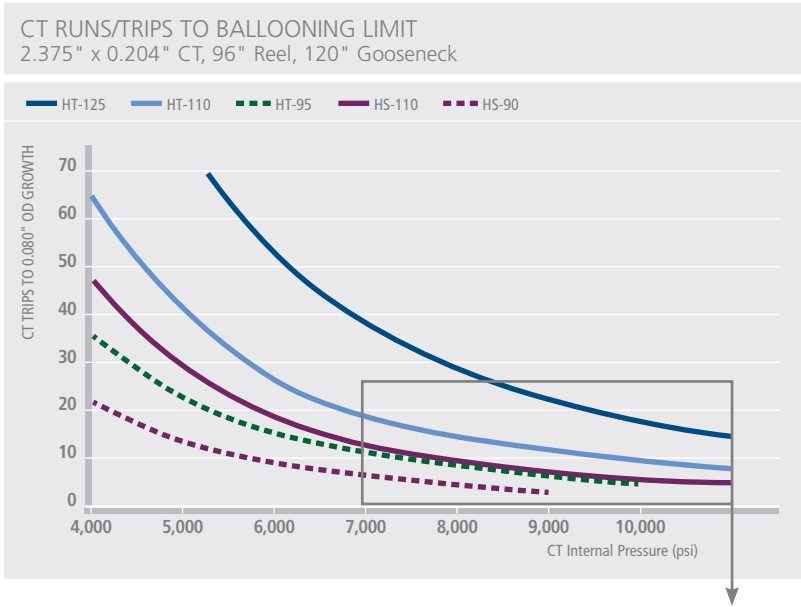
AVERAGE CT RUNS/TRIPS TO FAILURE
2.375" x 0.204" CT, 96" Reel, 120" Gooseneck



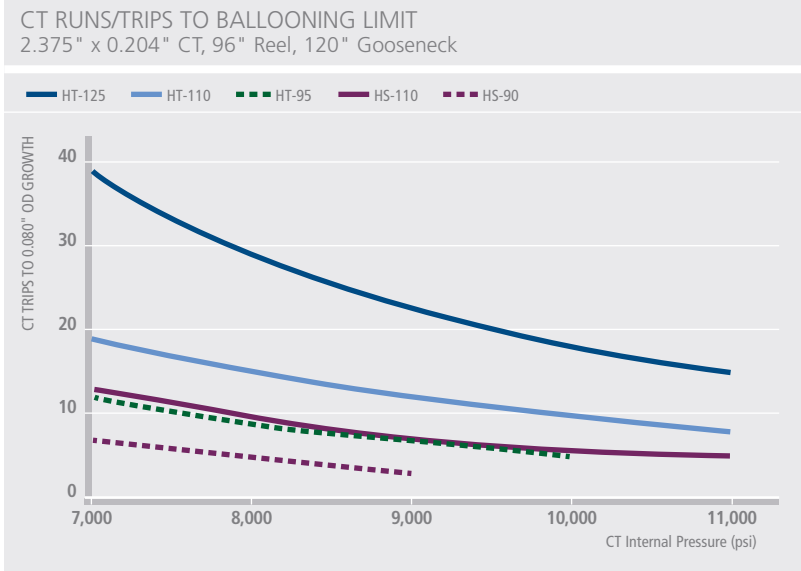
AVERAGE CT RUNS/TRIPS TO FAILURE
2.375" x 0.204" CT, 96" Reel, 120" Gooseneck



BlueCoil® products resist ballooning better than conventional coiled tubing, making them ideal for high-pressure applications.



A comparison of ballooning performance for BlueCoil® Technology grades vs. conventional HS-110 and HS-90 grades.



Extensive testing shows that fatigue performance of BlueCoil® products after sour (aqueous H₂S) exposure is markedly improved when compared to conventional coiled tubing grades. Additionally, fatigue life of conventional coiled tubing grades after sour exposure decreases as the coiled tubing's yield strength increases. BlueCoil® technology enables a more effective and more reliable usage of higher yield strength grades, as the sour fatigue life of BlueCoil® grades did not show to be adversely affected by yield strength increases in mild sour environments.

With BlueCoil® technology, the performance of the bias weld in sour fatigue is very similar to the performance of the base tube. The improved and homogeneous microstructure of BlueCoil® products results in significant sour fatigue improvements for both the base tube and bias

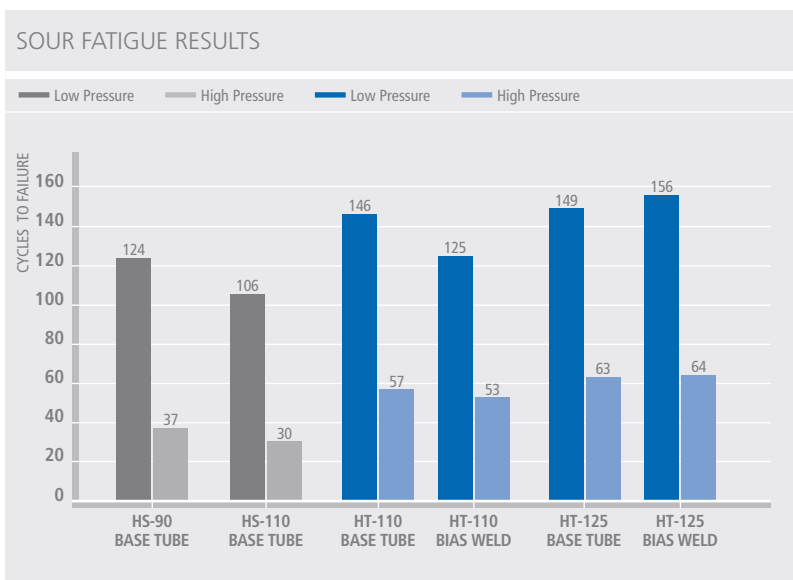
welds. In conventional coiled tubing, bias welds typically fail in sour fatigue much sooner than the base tube, even for the lower-strength grades.

BlueCoil® HT-95 grade has shown much better fatigue performance after 4-day exposure to severe sour environments than the conventional HS-90 grade under the same test conditions. The conventional 90 grade is the previously highest strength coiled tubing grade generally accepted for sour applications.

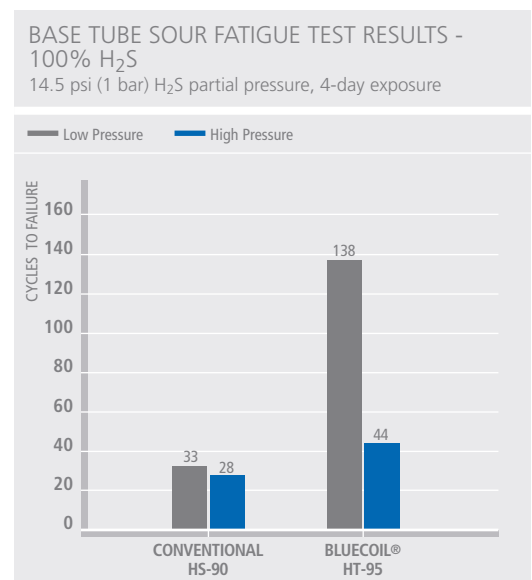
SIGNIFICANTLY BETTER SULFIDE STRESS CRACKING (SSC) RESISTANCE

BlueCoil® technology shows improved SSC performance, allowing the use of 20 ksi to 30 ksi higher yield strength grades in SSC environments compared to conventional coiled tubing grades.

Sour fatigue test results for MILD sour conditions



Sour fatigue test results for SEVERE sour conditions for HT-95 and HS-90 grades



VASTLY BETTER FIELD PERFORMANCE

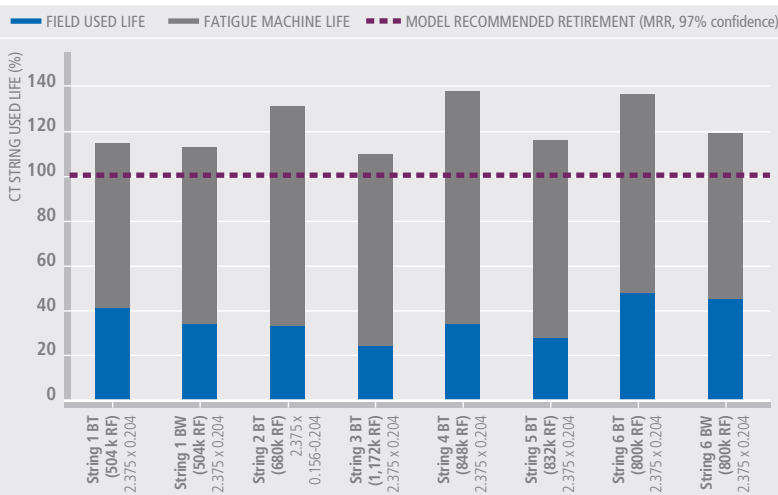
Testing of BlueCoil® HT-125 strings, including bias welds, after extensive field use in terms of both field used life and running feet (RF) shows that there is still a lot of remaining fatigue life even when HT-125 strings were used in field operations much longer than any other conventional coiled tubing strings under similar operating conditions. All tested HT-125 field string sections lasted beyond the statistical model recommended retirement(MRR) limit. The much improved predictability and reliability of BlueCoil® technology service life, in addition to significantly reduced risks of string parting even after string damage, can have profound effects on reducing operational risks, including quality, safety and environmental risks.

Greatly improved fatigue and ballooning performance of BlueCoil® technology also enables larger diameters for longer extended reach in lateral well sections, as well as higher pressures and flow rates for improved solids transport and more efficient coiled tubing jobs.

Easy to handle

- BlueCoil® products are compatible with the equipment currently used with conventional coiled tubing, so there is no need for special handling or equipment requirements.
- This includes injector handling under high pull load, BHA connectors, pipe cutters and BOP shear and slip performance.

FIELD LIFE AND REMAINING FATIGUE LIFE OF BLUECOIL® HT-125 FIELD CT STRINGS



Field used life and remaining fatigue life of HT-125 field CT strings.
 BT = base tube
 BW = bias weld
 RF = running feet

Mechanical Properties

Mechanical Properties of BlueCoil® Products

GRADE	YIELD STRENGTH		TENSILE STRENGTH		MAXIMUM HARDNESS
	MIN		MIN		
	psi	MPa	psi	MPa	HRc
HT-95	95,000	655	105,000	724	26
HT-110	110,000	758	118,000	814	30
HT-125	125,000	862	132,000	910	33

Technical Tables

HT-125 | 1.250" TO 2.875"

DIMENSIONS				NOMINAL WEIGHT	TUBE LOAD BODY		INTERNAL PRESSURE	TUBING AREA	TORSIONAL YIELD		INTERNAL CAPACITY	EXTERNAL DISPLACEMENT
Specified OD	Specified Wall	Minimum Wall	ID (calculated)		Yield Minimum	Tensile Minimum	Internal Yield Min.	Wall Area Min. Wall	Yield	Ultimate		
in	in	in	in	lb/ft	lb	lb	psi	in ²	ft.lb	ft.lb	Barrels/1000 ft	Barrels/1000 ft
1.250	0.109	0.104	1.032	1.332	48,800	51,600	20,400	0.374	1,192	1,293	1.03	1.52
	0.116	0.108	1.018	1.408	51,700	54,600	21,200	0.387	1,226	1,334	1.01	1.52
	0.125	0.117	1.000	1.506	55,200	58,300	22,900	0.416	1,299	1,423	0.97	1.52
	0.134	0.126	0.982	1.601	58,700	62,000	24,600	0.445	1,368	1,509	0.94	1.52
	0.145	0.137	0.960	1.715	62,900	66,400	26,600	0.479	1,448	1,610	0.90	1.52
	0.156	0.148	0.938	1.827	67,000	70,800	28,600	0.512	1,523	1,707	0.85	1.52
	0.175	0.167	0.900	2.014	73,900	78,000	31,900	0.568	1,640	1,864	0.79	1.52
1.500	0.116	0.108	1.268	1.719	63,000	66,600	17,800	0.472	1,845	1,980	1.56	2.19
	0.125	0.117	1.250	1.840	67,500	71,300	19,200	0.508	1,962	2,118	1.52	2.19
	0.134	0.126	1.232	1.960	71,900	75,900	20,600	0.544	2,074	2,252	1.47	2.19
	0.145	0.137	1.210	2.104	77,200	81,500	22,400	0.587	2,205	2,411	1.42	2.19
	0.156	0.148	1.188	2.245	82,300	86,900	24,100	0.629	2,330	2,564	1.37	2.19
	0.175	0.167	1.150	2.483	91,100	96,200	27,000	0.699	2,529	2,816	1.28	2.19
	0.190	0.178	1.120	2.665	97,700	103,200	28,600	0.739	2,635	2,955	1.22	2.19
1.750	0.116	0.108	1.518	2.029	74,400	78,600	15,300	0.557	2,591	2,753	2.24	2.97
	0.125	0.117	1.500	2.175	79,800	84,200	16,500	0.600	2,763	2,951	2.19	2.97
	0.134	0.126	1.482	2.318	85,000	89,800	17,800	0.643	2,929	3,144	2.13	2.97
	0.145	0.137	1.460	2.492	91,400	96,500	19,300	0.694	3,124	3,373	2.07	2.97
	0.156	0.148	1.438	2.662	97,700	103,100	20,800	0.745	3,311	3,596	2.01	2.97
	0.175	0.167	1.400	2.951	108,200	114,300	23,300	0.831	3,614	3,966	1.90	2.97
	0.190	0.178	1.370	3.173	116,400	122,900	24,800	0.879	3,778	4,171	1.82	2.97
2.000	0.116	0.108	1.768	2.340	85,800	90,600	13,400	0.642	3,464	3,654	3.04	3.89
	0.125	0.117	1.750	2.509	92,000	97,200	14,500	0.692	3,702	3,922	2.97	3.89
	0.134	0.126	1.732	2.677	98,200	103,700	15,600	0.742	3,932	4,184	2.91	3.89
	0.145	0.137	1.710	2.880	105,600	111,500	16,900	0.802	4,204	4,497	2.84	3.89
	0.156	0.148	1.688	3.080	113,000	119,300	18,200	0.861	4,466	4,803	2.77	3.89
	0.175	0.167	1.650	3.419	125,400	132,400	20,500	0.962	4,895	5,312	2.64	3.89
	0.190	0.178	1.620	3.682	135,000	142,600	21,800	1.019	5,131	5,597	2.55	3.89
2.375	0.116	0.108	2.018	2.665	97,700	103,200	28,600	0.739	2,635	2,955	1.22	2.19
	0.125	0.117	2.125	3.011	110,400	116,600	12,200	0.830	5,369	5,637	4.39	5.48
	0.134	0.126	2.107	3.215	117,900	124,500	13,200	0.890	5,716	6,023	4.31	5.48
	0.145	0.137	2.085	3.462	127,000	134,100	14,300	0.963	6,128	6,486	4.22	5.48
	0.156	0.148	2.063	3.706	135,900	143,600	15,400	1.035	6,527	6,940	4.13	5.48
	0.175	0.167	2.025	4.122	151,200	159,700	17,400	1.158	7,187	7,701	3.98	5.48
	0.190	0.178	1.995	4.445	163,000	172,200	18,500	1.229	7,553	8,129	3.87	5.48
2.625	0.116	0.108	2.268	2.831	103,800	109,600	30,700	0.789	2,763	3,124	1.16	2.19
	0.125	0.117	2.250	3.077	111,600	117,900	33,000	0.842	3,004	3,373	1.10	2.19
	0.134	0.126	2.232	3.323	119,400	126,300	35,300	0.896	3,245	3,614	1.04	2.19
	0.145	0.137	2.210	3.568	127,200	134,700	37,600	0.950	3,486	3,853	0.98	2.19
	0.156	0.148	2.188	3.813	135,000	143,100	39,900	1.004	3,727	4,096	0.92	2.19
	0.175	0.167	2.150	4.059	142,800	151,500	42,200	1.058	3,968	4,365	0.86	2.19
	0.190	0.178	2.120	4.305	150,600	160,200	44,500	1.112	4,209	4,634	0.80	2.19
2.875	0.116	0.108	2.518	2.831	103,800	109,600	30,700	0.789	2,763	3,124	1.16	2.19
	0.125	0.117	2.500	3.077	111,600	117,900	33,000	0.842	3,004	3,373	1.10	2.19
	0.134	0.126	2.482	3.323	119,400	126,300	35,300	0.896	3,245	3,614	1.04	2.19
	0.145	0.137	2.460	3.568	127,200	134,700	37,600	0.950	3,486	3,853	0.98	2.19
	0.156	0.148	2.438	3.813	135,000	143,100	39,900	1.004	3,727	4,096	0.92	2.19
	0.175	0.167	2.400	4.059	142,800	151,500	42,200	1.058	3,968	4,365	0.86	2.19
	0.190	0.178	2.370	4.305	150,600	160,200	44,500	1.112	4,209	4,634	0.80	2.19

- The coiled tubing data in this handbook is for new tubing at specified minimum strength.
- Strips with continuous gradual tapers are used for all wall thickness transitions within tapered string design.
- Tube Body Load: Yield & Tensile minimums calculated based on specified wall.
- Internal Yield: Internal pressure to cause yielding based on minimum yield strength and minimum wall thickness.
- Torsional Yield is calculated using minimum wall thickness and minimum yield strength.



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